DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 08 March 2010 has been entered.

Response to Arguments

2. Applicant's arguments filed 08 March 2010 have been fully considered but they are not persuasive. In the response filed Applicant argues that the cited references do not teach analog compensation units which provide color interpolation, on-the-fly color compensation and/or fixed pattern noise reduction without the use of white balance amplifiers or controllers as claimed. However, the examiner disagrees. Specifically, von Stein discloses an imaging system which includes amplifiers (i.e. analog compensation units) which amplify the color components on-the-fly. As broadly as claimed, this may be considered "color compensation" since the claims as written do not define what type of compensation is applied to the signals, or how the compensation is to be applied. Furthermore, von Stein does not require the use of white balance amplifiers or white balance controllers and may be modified as taught by the secondary references to provide analog summing and simultaneous readout of a 2x2 pixel block

without requiring the addition of white balance amplifiers or white balance controllers. Therefore, it is believed that von Stein, Hashimoto, Ogawa and Roberts teach an imaging system as claimed.

3. While Applicant further argues that the claimed features are “significantly different" from the cited references, Applicant has not clearly stated how the claims are believed to be different from the features of the cited references. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

4. Therefore, Applicant’s arguments are not considered persuasive and the rejections based on von Stein, Hashimoto, Ogawa and Roberts are maintained.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 1, 3, 4, 6-8, 12-20, 22, 26, 28-33, 35, 36, 39 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over von Stein et al. (US 6,529,243) in view of Hashimoto (US 4,768,085) in view of Ogawa et al. (US 7,142,233) in view of Roberts (5,541,654).

[claim 1]

In regard to claim 1, note that von Stein discloses a color imaging system for compensating a color response, comprising: a first, second and third analog

compensation units coupled to respective colors and adapted to modify a readout of the color signals to apply on-the-fly color compensation (Figure 1, Items 7a-7c; note that as broadly as claimed, the analog compensation units of von Stein may be considered to provide “color compensation” since the color values are altered). Further note that the analog compensation units of von Stein are not disclosed as being white balance amplifiers, nor is the system disclosed as using a white balance controller. However, von Stein uses multiple arrays of pixel sensors to capture images, and does not disclose a single array using a color filter comprising multiple color filter components as claimed.

Hashimoto discloses a color imaging system for compensating a color response comprising: an array of pixel sensor elements (e.g. Figure 1); a color filter including a plurality of color filter components organized in a predefined pattern, the color filter overlaying at least a portion of the array, wherein the pixel sensor elements include at least one element associated with a first color filter component, at least one element associated with a second color component and at least one element associated with a third color component (e.g. Figure 1; c. 3, ll. 37-47); an analog summer (i.e. summing amplifier) coupled to two elements associated with the third color filter component and outputting an analog sum of the two elements (Figure 2, Item 2a3; Figure 5); and an array controller (Figure 1, Items 2a1, 2a2). The array of Hashimoto allows for simultaneous output of R, G and B color signals without the need for multiple arrays and optical splitters/mirrors. Therefore, it would be obvious to use the array of Hashimoto to capture the image signals for the system of von Stein to reduce the total number of

components, the complexity and the cost of the system. Hashimoto further discloses simultaneous readout of two horizontal lines, but does not explicitly disclose simultaneous readout of a 2x2 block.

Ogawa discloses an image sensor which reads out pixel signals in units of blocks (i.e. simultaneous readout of a 2x2 block; Figure 4; c. 3, ll. 57-59). Ogawa further discloses that this manner of readout the basic blocks necessary for interpolation processing are available and an interpolated signal for an arbitrarily read region can be obtained at random (c. 7, ll. 39-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform readout in units of blocks as taught by Ogawa in the image sensor of Hashimoto in order to allow for interpolated signals of arbitrary regions to be obtained at random. It is further noted that the filter pattern of Hashimoto is not a Bayer pattern (Figure 1, note that the g1 and g2 pixels are not offset diagonally). While Ogawa discloses an embodiment which uses a Bayer pattern, Ogawa is not limited in any way to this arrangement (c. 7, ll. 55-60). For example, it is noted that Ogawa discloses a second embodiment which does not use a Bayer pattern (Figures 7-10). However, von Stein in view of Hashimoto in view of Ogawa lacks readout of components in a selected window of the array while other sections of the array are not processed.

Roberts teaches the use of a windowing operation in which a subset of the array (Figure 6, Items 172 or 174) are readout independently from the rest of the array. Roberts further discloses that the rest of the array may not be read out (i.e. processed) while the window may be scanned at a frame rate much higher than if the entire array

were to be read out (c. 10, ll. 9-21). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to implement a windowing operation in the device of Hashimoto in order to achieve higher frame rates by reading out (i.e. processing) only a subset of the entire array. The examiner notes that Roberts discloses the use of a control circuit 32 and decoding and latching circuits 22 and 24 (c. 4, ll. 20-41).

[claim 3]

In regard to claim 3, note that Hashimoto discloses an array which is arranged in a plurality of rows and columns (e.g. Figure 1).

[claim 4]

In regard to claim 4, note that Hashimoto discloses an array controller adapted to control readout of a plurality of pixel sensor elements in parallel (c.4, ll. 5-15).

[claim 6]

In regard to claim 6, note that von Stein discloses analog compensation units which are gain amplifiers (c.4, ll. 16-19).

[claims 7 and 8]

In regard to claims 7 and 8, von Stein discloses programmable gain amplifiers which are implemented as a separate stage (Figure 1, Items 7a-7c; c. 4, ll. 16-19).

[claim 12]

In regard to claim 12, note that Hashimoto discloses color filter components including the colors of red, blue and green (Figure 1; c. 3, ll. 37-47).

[claims 13 and 14]

In regard to claims 13 and 14, von Stein in view of Hashimoto discloses all limitations except for the interlaced or odd and even readout modes of columns and rows. However, the use of independent readout of even and odd rows or columns is well known in the art to create industry standard NTSC TV signals or to reduce the amount of data readout during for a frame when a high frame rate is more important than high resolution. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to use even and odd row or column readout with the imaging system of von Stein in view of Hashimoto to create NTSC TV signals or to reduce the resolution in order to achieve higher frame rates.

[claim 15]

In regard to claim 15, note that Ogawa discloses an array controller which causes a plurality of substantially simultaneous, independent readouts for a plurality of rows and some columns (Figure 4; c. 3, ll. 57-59).

[claims 16 and 19]

In regard to claims 16 and 19, von Stein in view of Hashimoto discloses all limitations except for a passive CCD imaging device. However, the use of CCD imagers in cameras is well known in the art to provide higher sensitivity than other imagers, such as CMOS imagers (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a passive CCD imager as the imaging device of von Stein in view of Hashimoto to achieve higher sensitivity.

[claims 17 and 18]

In regard to claims 17 and 18, von Stein in view of Hashimoto discloses all limitations except for an active CMOS imaging sensor device. However, it is well known in the art to use active CMOS image sensors in applications where nondestructive readout of pixels is required, such as in Hashimoto (e.g. c. 3, ll. 48-52). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to use an active CMOS image sensor in the imaging system of von Stein in view of Hashimoto to allow for non-destructive readout of the image sensor (Official Notice).

[claim 20]

In regard to claim 20, note that at least a first pixel sensor element of Hashimoto is associated with a different color than a second, neighboring pixel sensor element (Hashimoto; Figure 1).

[claim 22]

In regard to claim 22, note that von Stein in view of Hashimoto discloses all limitations except for a complementary color scheme include yellow, cyan and magenta color filters. However, the use of yellow, cyan and magenta is a well known design alternative to the use of red, green and blue color filters as is well known in the art. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use yellow, cyan and magenta color filters to achieve color images (Official Notice).

[claim 26]

In regard to claim 26, von Stein discloses a method of compensating a color response in an analog domain of pixel sensor elements comprising: amplifying an

analog output from a plurality of elements of first and second color components to apply on-the-fly color compensation (Figure 1, Items 7a-7c; note that as broadly as claimed, the analog compensation units of von Stein may be considered to provide “color compensation” since the color values are altered). Further note that the analog compensation units of von Stein are not disclosed as being white balance amplifiers, nor is the system disclosed as using a white balance controller. However, von Stein does not disclose summing two element outputs of a second color prior to amplifying.

Hashimoto discloses an array wherein two said elements outputs are summed together prior to being output to an amplifier (Figure 5, Item 3 and (G1+G2); c. 4, ll. 55-59; c. 5, ll. 49-60). The array of Hashimoto allows for simultaneous output of R, G and B color signals without the need for multiple arrays and optical splitters/mirrors. Therefore, it would be obvious to use the array of Hashimoto to capture the image signals for the system of von Stein to reduce the total number of components, the complexity and the cost of the system. Hashimoto further discloses simultaneous readout of two horizontal lines, but does not explicitly disclose simultaneous readout of a 2x2 block.

Ogawa discloses an image sensor which reads out pixel signals in units of blocks (i.e. simultaneous readout of a 2x2 block; Figure 4; c. 3, ll. 57-59). Ogawa further discloses that this manner of readout the basic blocks necessary for interpolation processing are available and an interpolated signal for an arbitrarily read region can be obtained at random (c. 7, ll. 39-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform readout in units of

blocks as taught by Ogawa in the image sensor of Hashimoto in order to allow for interpolated signals of arbitrary regions to be obtained at random. It is further noted that the filter pattern of Hashimoto is not a Bayer pattern (Figure 1, note that the g1 and g2 pixels are not offset diagonally). While Ogawa discloses an embodiment which uses a Bayer pattern, Ogawa is not limited in any way to this arrangement (c. 7, ll. 55-60). For example, it is noted that Ogawa discloses a second embodiment which does not use a Bayer pattern (Figures 7-10). However, Hashimoto in view of Ogawa lacks readout of components in a selected window of the array while other sections of the array are not processed.

Roberts teaches the use of a windowing operation in which a subset of the array (Figure 6, Items 172 or 174) are readout independently from the rest of the array. Roberts further discloses that the rest of the array may not be read out (i.e. processed) while the window may be scanned at a frame rate much higher than if the entire array were to be read out (c. 10, ll. 9-21). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to implement a windowing operation in the device of Hashimoto in order to achieve higher frame rates by reading out (i.e. processing) only a subset of the entire array. The examiner notes that Roberts discloses the use of a control circuit 32 and decoding and latching circuits 22 and 24 (c. 4, ll. 20-41).

[claim 28]

In regard to claim 28, note that von Stein discloses generating a compensated analog readout comprising amplifying the analog readout for the plurality of elements of

the first color component with a first programmable gain amplifier (Figure 1, Items 7a-7c; c. 4, ll. 16-22).

[claim 29]

In regard to claim 29, note that von Stein discloses determining an optical level of color compensation for the analog readout of the plurality of elements of the first color component (c. 4; ll. 16-22; i.e. providing corrected video signals).

[claim 30]

In regard to claim 30, von Stein does not disclose generating a compensated analog readout depending on the temperature of the system. Official Notice is taken that it is well known to compensate amplifiers for temperature variations in the system to ensure a stable output over a range of temperatures. Therefore, it would be obvious to generate the output by compensating the amplifier for a temperature of the system to ensure that a stable output is obtained even when temperature variations are present.

[claim 31]

In regard to claim 31, note that the Hashimoto discloses sensor elements that are associated with the colors of red, blue and green (Figure 1; c. 3, ll. 37-47).

[claim 32]

In regard to claim 32, note that Hashimoto in view of Ogawa discloses an act of generating comprising: generating an independent readout for even numbered rows (i.e. Figure 2, Items G2 and B2); generating an independent readout for odd numbered rows (i.e. Figure 2, Items G1 and R1); generating an independent readout for even numbered columns (i.e. Figure 2, Items R1 and B2); and generating an independent readout for

odd numbered columns (i.e. Figure 1, Items G1 and G2; The office notes that each of the pixel elements G1, B1, G2 and R2 are readout independently (i.e. on independent readout lines) from each other which meets the limitation of the claims, such that at least one element associated with red, blue and green filter components are coupled to first, second and third gain amplifiers respectively (Figure 5). Further note that von Stein discloses first, second and third programmable gain amplifiers for R, G and B color components (Figure 1, Items 7a-7c).

[claim 33]

In regard to claim 33, note that Ogawa discloses an act of generating comprising generating a plurality of substantially simultaneous, independent readouts for the set of rows and the set of columns (Figure 4; c. 3, ll. 57-59).

[claim 35]

In regard to claim 35, note that von Stein discloses a color imaging system for compensating a color response, comprising: a first, second and third analog compensation units coupled to respective colors and adapted to modify a readout of the color signals to apply on-the-fly color compensation (Figure 1, Items 7a-7c; note that as broadly as claimed, the analog compensation units of von Stein may be considered to provide “color compensation” since the color values are altered). Further note that the analog compensation units of von Stein are not disclosed as being white balance amplifiers, nor is the system disclosed as using a white balance controller. However, von Stein uses multiple arrays of pixel sensors to capture images, and does not

disclose a single array using a color filter comprising multiple color filter components as claimed.

Hashimoto discloses a color imaging system for compensating a color response comprising: an array of pixel sensor elements (e.g. Figure 1); a color filter including a plurality of color filter components organized in a predefined pattern, the color filter overlaying at least a portion of the array, wherein the pixel sensor elements include at least one element associated with a first color filter component, at least one element associated with a second color component and at least one element associated with a third color component (e.g. Figure 1; c. 3, ll. 37-47); an analog summer (i.e. summing amplifier) coupled to two elements associated with the third color filter component and outputting an analog sum of the two elements (Figure 2, Item 2a3; Figure 5); and an array controller (Figure 1, Items 2a1, 2a2). The array of Hashimoto allows for simultaneous output of R, G and B color signals without the need for multiple arrays and optical splitters/mirrors. Therefore, it would be obvious to use the array of Hashimoto to capture the image signals for the system of von Stein to reduce the total number of components, the complexity and the cost of the system. Hashimoto further discloses simultaneous readout of two horizontal lines, but does not explicitly disclose simultaneous readout of a 2x2 block.

Ogawa discloses an image sensor which reads out pixel signals in units of blocks (i.e. simultaneous readout of a 2x2 block; Figure 4; c. 3, ll. 57-59). Ogawa further discloses that this manner of readout the basic blocks necessary for interpolation processing are available and an interpolated signal for an arbitrarily read region can be

obtained at random (c. 7, ll. 39-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform readout in units of blocks as taught by Ogawa in the image sensor of Hashimoto in order to allow for interpolated signals of arbitrary regions to be obtained at random. It is further noted that the filter pattern of Hashimoto is not a Bayer pattern (Figure 1, note that the g1 and g2 pixels are not offset diagonally). While Ogawa discloses an embodiment which uses a Bayer pattern, Ogawa is not limited in any way to this arrangement (c. 7, ll. 55-60). For example, it is noted that Ogawa discloses a second embodiment which does not use a Bayer pattern (Figures 7-10). However, Hashimoto in view of Ogawa lacks readout of components in a selected window of the array while other sections of the array are not processed.

Roberts teaches the use of a windowing operation in which a subset of the array (Figure 6, Items 172 or 174) are readout independently from the rest of the array. Roberts further discloses that the rest of the array may not be read out (i.e. processed) while the window may be scanned at a frame rate much higher than if the entire array were to be read out (c. 10, ll. 9-21). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to implement a windowing operation in the device of Hashimoto in order to achieve higher frame rates by reading out (i.e. processing) only a subset of the entire array. The examiner notes that Roberts discloses the use of a control circuit 32 and decoding and latching circuits 22 and 24 (c. 4, ll. 20-41). Roberts further discloses the use of the control circuit to perform

windowing by resetting and reading of pixels under variable patterns (c. 7, ll. 33-45).

[claim 36]

In regard to claim 36, note that Hashimoto discloses sensor elements arranged in rows and columns (Figure 1).

[claim 39]

In regard to claim 39, von Stein discloses a method of compensating a color response in an analog domain of pixel sensor elements comprising: amplifying an analog output from a plurality of elements of first and second color components to apply on-the-fly color compensation (Figure 1, Items 7a-7c; note that as broadly as claimed, the analog compensation units of von Stein may be considered to provide “color compensation” since the color values are altered). Further note that the analog compensation units of von Stein are not disclosed as being white balance amplifiers, nor is the system disclosed as using a white balance controller. However, von Stein does not disclose summing two element outputs of a second color prior to amplifying.

Hashimoto discloses an array wherein two said elements outputs are summed together prior to being output to an amplifier (Figure 5, Item 3 and (G1+G2); c. 4, ll. 55-59; c. 5, ll. 49-60). The array of Hashimoto allows for simultaneous output of R, G and B color signals without the need for multiple arrays and optical splitters/mirrors. Therefore, it would be obvious to use the array of Hashimoto to capture the image signals for the system of von Stein to reduce the total number of components, the complexity and the cost of the system. Hashimoto further discloses simultaneous

readout of two horizontal lines, but does not explicitly disclose simultaneous readout of a 2x2 block.

Ogawa discloses an image sensor which reads out pixel signals in units of blocks (i.e. simultaneous readout of a 2x2 block; Figure 4; c. 3, ll. 57-59). Ogawa further discloses that this manner of readout the basic blocks necessary for interpolation processing are available and an interpolated signal for an arbitrarily read region can be obtained at random (c. 7, ll. 39-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform readout in units of blocks as taught by Ogawa in the image sensor of Hashimoto in order to allow for interpolated signals of arbitrary regions to be obtained at random. It is further noted that the filter pattern of Hashimoto is not a Bayer pattern (Figure 1, note that the g1 and g2 pixels are not offset diagonally). While Ogawa discloses an embodiment which uses a Bayer pattern, Ogawa is not limited in any way to this arrangement (c. 7, ll. 55-60). For example, it is noted that Ogawa discloses a second embodiment which does not use a Bayer pattern (Figures 7-10). However, Hashimoto in view of Ogawa lacks readout of components in a selected window of the array while other sections of the array are not processed.

Roberts teaches the use of a windowing operation in which a subset of the array (Figure 6, Items 172 or 174) are readout independently from the rest of the array. Roberts further discloses that the rest of the array may not be read out (i.e. processed) while the window may be scanned at a frame rate much higher than if the entire array were to be read out (c. 10, ll. 9-21). Therefore, it would have been obvious to one of

ordinary skill in the art at the time the invention was made to implement a windowing operation in the device of Hashimoto in order to achieve higher frame rates by reading out (i.e. processing) only a subset of the entire array. The examiner notes that Roberts discloses the use of a control circuit 32 and decoding and latching circuits 22 and 24 (c. 4, ll. 20-41).

[claim 40]

In regard to claim 40, note that Hashimoto discloses modifying a third analog signal corresponding to the output of a third pixel element in the imager to color correct the third pixel (Figure 5, Item 5; c. 4, ll. 55-59)

7. Claim 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over von Stein et al. (US 6,529,243) in view of Hashimoto (US 4,768,085) in view of Ogawa et al. (US 7,142,233) in view of Roberts (US 5,541,654) as applied to claim 7 above, and in further view of Zhou et al. (IEEE).

[claims 9 and 10]

In regard to claims 9 and 10 it can be seen that von Stein in view of Hashimoto in view of Ogawa in view of Roberts disclose all limitations except for programmable gain amplifiers contained within the pixel circuitry and within a plurality of column buffers. However, such a system is well known in the art, (for example see Zhou, Figures 1 and 2) as a way to reduce the overall size of imaging systems. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to alter the design of von Stein in view of Hashimoto with the gain amplifiers of Zhou

contained in the pixel circuitry of the array in a plurality of column buffers to reduce the overall size.

8. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over von Stein et al. (US 6,529,243) in view of Hashimoto (US 4,768,085) in view of Ogawa et al. (US 7,142,233) in view of Roberts (US 5,541,654) as applied to claim 1 above, and in further Sano et al. (IEEE).

[claim 23]

In regard to claim 23, note that von Stein in view of Hashimoto in view of Ogawa in view of Roberts discloses all limitations except for a micro-lens layer. However, the use of micro-lens layers on image sensors is well known in the art to increase photosensitivity of the image sensor arrays, for example see Sano et al. (IEEE). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a micro-lens layer with the imaging system of Hashimoto in view of Roberts to increase photosensitivity.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TIMOTHY J. HENN whose telephone number is (571)272-7310. The examiner can normally be reached on M-F 11-7.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Ometz can be reached on (571) 272-7593. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Timothy J Henn/
Primary Examiner, Art Unit 2622